Comparison of Macular Pigment Optical Density in Patients with AMD and Healthy Control Subjects

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Introduction. Age-related macular degeneration (AMD) affects the macula and is a leading cause of significant and irreversible loss of central visual acuity in persons aged over 60 in developed countries [1, 2]. Epidemiological studies estimate that the prevalence of AMD in Australia, Europe and North America is 0.2% in 55 - 64 year-old patients and it increases to 13 percent in the age group of 85 years [3]. According to the Blind Register Centre, about 50% of blind people lose vision due to ADM in Great Britain [4]. Macular pigment accumulates in the central retina and is composed of the carotenoids, lutein, zeaxanthin and meso-zeaxanthin, which give the macula its characteristic yellow colour. Lutein and zeaxanthin are not synthesized de novo in humans and are of dietary origin, whereas meso-zeaxanthin has been reported to be predominantly non-dietary and formed following conversion from lutein in the retina [5, 6]. Macular pigment confers powerful antioxidant protection and also filters actinic short wavelength, blue light, limiting the (photo-)oxidative damage to retinal cells [7]. These properties of macular pigment are believed to limit the development and/or progression of AMD [8]. The aim of our research was to evaluate macular pigment optical density (MPOD) in patients with early age-related macular degeneration (AMD) and compare results with healthy age and gender matched controls.

Materials and methods. Having obtained permission from the Kaunas Regional Biomedical Research Ethics Committee, the study was conducted in the Department of Ophthalmology at Lithuanian University of Health sciences. The inclusion criteria for patients with AMD were as follows: 1) patients of both genders, diagnosed with early mild or early intermediate AMD who did not have other eye disorders found on detailed ophthalmologic examination; 2) the diagnosis confirmed by colour fundus photography; 3) participation consent. The inclusion criteria for healthy controls were as follows: 1) no ophthalmological eye disorders were found on detail ophthalmological evaluation; 2) participation consent.
A total of 25 patients with early AMD (aged 53.86 ± 18.25 years [range 40 - 74]) and 25 healthy subjects (aged 48.19 ± 17.94 years [range 24 - 78]) were included into our study. In this study the visual acuity as well as the transparency of the cornea and lens, and the fundus were investigated in the patients. Pupils of the subjects were dilated with tropicamid 1% or cycloglyli 1%. After dilation of the pupils, fundoscopy was performed with an ophthalmoscope of the direct monocular type and the slit-lamp, using a double aspheric lens of +78 diopters. A peripheral retinal examination was performed using an indirect ophthalmoscope. Results of the eye examination were recorded on standardized forms that we developed for this study. Stereoscopic color fundus photographs of the macula were obtained: centered at 45o and 30o to the fovea for a detailed fundus analysis.

The optional macular pigment density module for the Visucam 200 used the reflectance of a single 460-nm wavelength based on a single blue-reflection fundus image to determine MPOD and its spatial distribution. A shading correction is used that approximates the reflectance of the fundus in absence of MP. It is based on a three-dimensional parabolic function automatically fitted to fundus reflectance at peripheral locations. The subject was positioned in front of the fundus camera and instructed to look at a target inside. The fundus was illuminated by a monochromatic blue light. Four MPOD parameters were automatically calculated: maximum optical density (MPOD measured at the peak); mean OD (mean MPOD within the measurement area); area (area where macular pigment could be detected); and volume (sum of all optical densities, as recommended by the manufacturer).

Statistical Analysis. Mean and standard deviation of MPOD were calculated. MPOD levels between males and females were compared using t-test for two independent samples.

Results. The mean of MPOD in patients with early AMD was 0.129 ± 0.029. The mean of MPOD in healthy age and gender matched controls was 0.120 ± 0.019. Patients with early AMD did not showed a reduced MPOD as compared to the healthy control group, p = 0.091.

Conclusion. There was no statistically significant difference of MPOD in patients with early AMD compared to healthy controls.

Discussion. The question whether AMD patients show reduced MPOD as compared to healthy subjects is discussed controversially in literature. The present data indicate that patients with AMD are characterized by a relative lack of MPOD as compared to healthy control subjects. Whether a difference in MPOD was found between healthy subjects and patients with AMD in previous studies strongly depends on the inclusion/exclusion criteria, the sample size and the employed technique. Also, in total, the mean MPOD as measured in this aged population of early AMD patients and healthy individuals is remarkably lower when compared with values published by other investigators measuring with similar techniques. A future study comparing the population of our study with...
age-matched populations with different hereditary and geographic characteristics would be interesting.

References

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